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## THE BALSAM WOOLLY APHID

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This insect was introduced to North America from Europe about the beginning of the century before the days of plant quarantine, probably on nursery stock. It has since spread throughout Nova Scotia, Prince Edward Island, and the southern half and north-eastern parts of New Brunswick. It was first discovered in Newfoundland in 1949 and had evidently been present there for some 15 years. There are three distinct areas of infestation in this Province. The main area extends over some 2,000 square miles in the southwest of the Island, from Cape Ray to Corner Brook, with scattered infestations as far north as the head of Deer Lake and near Trout River, Bonne Bay. A small area occurs in the east near St. John's and another of about 50 square miles was discovered in 1956 on the Burin Peninsula near Winterland.

Only true firs (species of Abies) are attacked, but balsam fir is particularly susceptible and much damage has been done to this tree in the above areas.



Fig. 1. "Stem attack" in summer (A) heavy (dying), (B) moderate (will probably die next year).

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### Description and Habits

When fully grown the aphid is less than a millimeter long and not easily seen without a magnifying glass. However, it secretes a covering of white wax threads and appears as a dot of white 'wool' within which can be found its roughly spherical, purplish-black body. This is attached to the tree by a slender feeding tube inserted into the bark or shoot. The 'wool' remains, often for a year or more after the insect dies, and severely infested trees may be recognized by the light-gray appearance of parts of the stem caused by a covering of the wax threads of thousands of dead or living aphids.

Closer examination during the summer will reveal the eggs and young stages as well as the adults. There are no males. The adult female can lay 100 or more eggs but these commence to hatch before egg laying is completed. The unhatched eggs are oval and light brown with a purple tinge. They will be found attached to the bark by a silk thread in bunches behind the mother. Small newly hatched larvae of similar color will often be found crawling rapidly over the bark. As soon as a 'crawler' finds a suitable place it



Fig. 2. "Gouty" tree with top killed.



Fig. 3. Twig showing "gout" caused by aphid.

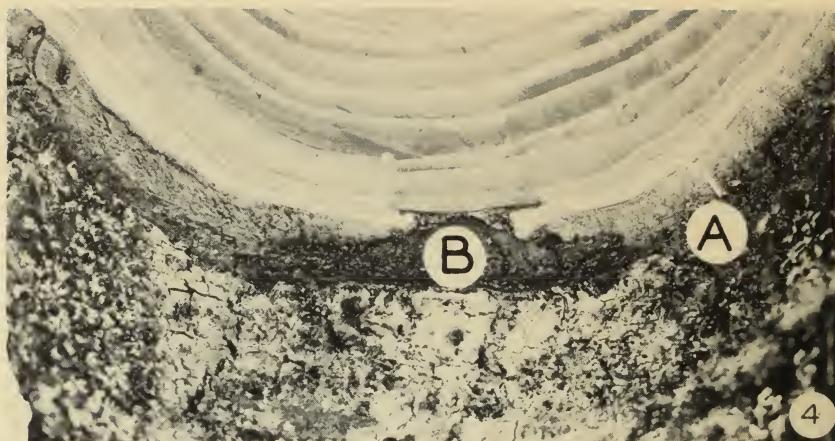


Fig. 4. Section of stem of tree infested 7 years and dying. Note abnormal red wood followed by small rings (A) and dead spot of bark (B).

inserts its feeding tube and becomes stationary. It then turns black and produces a fringe of white wax plates around the edge of the body and down the back. This stage always remains dormant for a period and is the only one that lives through the winter. It can be found at any time of the year on any part of the tree except the needles, chiefly in crevices on the bark, under lichens, under old bud scales, or at the base of new buds.

There are two generations a year. In the spring, about the time the buds begin to swell, the first-stage larvae that have successfully over-wintered begin to feed. Later they molt, changing to a more spherical form covered with wax threads. After two more molts they become adults and begin to lay eggs, generally during the latter part of May. The greatest number of first-generation adults will be found in the latter part of June when eggs and 'crawlers' are also numerous. The latter insert their mouth-parts and after a resting stage of ten days or longer, develop into the second generation. The adults of the second generation commence laying eggs in August and all stages may be found until some time in November when only the dormant first-stage larvae remain alive.

The second generation is more numerous than the first and the best time to detect new infestations is during September when the greatest quantity of 'wool' is produced. Later this becomes less conspicuous owing to weathering.

#### Effects on Tree

The insect feeds by probing between the cells of the tissue in the outer bark. It injects a salivary substance that has striking effects on the growth of the stem and twigs. At first growth is

stimulated. Annual rings may be larger and somewhat irregular and the wood formed is reddish, hard, and brittle (often called "boxy"). As this wood shrinks differently from the normal wood, lumber from trees that have been heavily infested warps and checks badly.

Feeding on the twigs causes them to swell and become distorted. The swellings are particularly noticeable at the nodes. Bud growth may be stopped and the twigs start to die back from the ends. Such injury is often most noticeable in the top of the tree and dead, swollen, sometimes flattened tops are characteristic of an infested stand. Before the cause was known this condition was called 'gout disease'. It results from a moderately heavy attack on the branches and new shoots that has persisted for a number of years. It is most striking when immature, vigorous trees are affected.

### Damage

The damage takes several forms:

(1) Trees may be killed within two or three years by a rapidly developing, heavy attack on the stem--often referred to as



Fig. 5. Immature stand showing severe "gout".

'stem attack'. The foliage turns red and remains on the tree for about a year. Such trees show slight or no symptoms of 'gout'. They may be scattered or in small groups and are generally the larger trees in the stand. They remain salvable as pulpwood for about two years. This type of attack is most frequently found in newly infested areas at some distance from the coast.

(2) Trees may be killed more slowly by less severe attack, which causes dying back of the top and branches. These are the trees that show the most striking symptoms of 'gout'. Stems sometimes taper rapidly and may contain some of the abnormal red wood. The process of dying may take from 10 to 25 years, during which there is little or no height growth. They may occupy growing space but fail to reach merchantable size. This is the most common type of injury in coastal areas.

(3) Some trees may recover, more or less completely, from either 'stem attack' or 'gout', but suffer loss of growth. The recovery may be temporary or permanent. The amount of injury varies with the resistance of the individual tree as well as the severity of infestation, and some trees in a stand will survive an outbreak with little or no injury. Recovering trees may show thin crowns with strong growth in the extreme top, which is often flat or bunched.

(4) Those trees that have had a persistent, moderately heavy infestation on the stems when immature produce a poor quality of lumber and a somewhat lower quality of pulp.

(5) Advance growth beneath a heavily infested overstory of balsam fir may be killed or severely retarded but generally there is adequate survival for the next crop. Reproduction without an overstory is not often badly injured up to about 20 years of age, although it may sometimes become very gouty near the coast.

(6) Although immature stands with a high proportion of balsam may suffer severely, those in which spruce predominates may benefit somewhat from the resulting thinning of the balsam and increase in spruce content.

### Control

Predaceous insect enemies are being introduced from Europe and it is hoped that the destructiveness of the aphid will eventually be reduced. It is likely, however, to remain a pest for some time and will probably never be brought under complete control.

Loss can be minimized by intensive cutting of infested stands before serious mortality takes place and the dead trees become unfit for salvage. The cutting of all mature balsam fir in an infested stand will also help to check the multiplication and

spread of the insect if the cutting is carried out in the early stages of infestation. Isolated advance infestations often appear outside the area of general distribution and it is particularly desirable to undertake control cuttings in such cases by prompt removal of all infested trees and harvesting of all balsam fir of merchantable size in the neighborhood. Complete eradication from such areas is not likely to be possible but the spread of the infestation will be checked.

Cutting is best done in the winter when the insect cannot be spread. Unpeeled wood should not be moved into uninfested areas except during winter (December to March) and only then if thorough precautions can be taken to see that it is floated, peeled, or manufactured before the end of March. All vehicles used for transporting infested wood from April to November should be thoroughly cleaned with a hose before they are taken into uninfested areas.

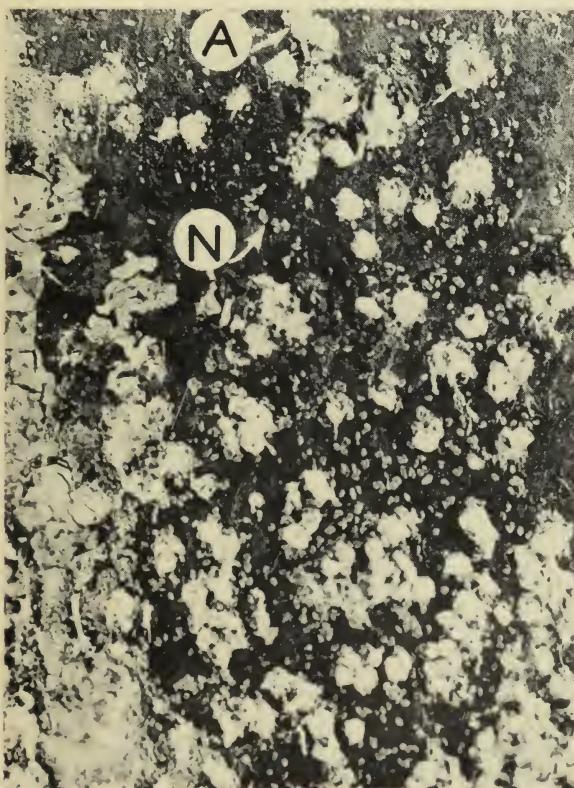


Fig. 6. Infested bark showing larvae (N) and "wool" of adults (A).  
Slightly enlarged.

### Recognition of Infestations

Familiarity with all the symptoms of the presence of the insect is essential to control and to efficient salvage. The symptoms are:

- (1) Dots of white 'wool' on any part of a balsam fir.
- (2) Twigs with swellings, especially at the nodes.
- (3) A dead tree with the remains of 'wool' on the bark and injury to reproduction beneath.
- (4) A tree with shortened, drooping shoots or a dead top showing nodal swellings on closer examination.

Samples of apparently infested bark or twigs should be sent to the nearest Forest Biology Laboratory for positive identification.

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